[No. 75]

Metropolitan Sewers.

REPORT

ON THE

TRAPPING OF GULLIES,

IN PURSUANCE OF THE ORDER OF WORKS COMMITTEE, OF THE 17TH SEPTEMBER, 1849.

BY

THE CONSULTING ENGINEER.

THE trapping of gullies is a subject upon which so much has been written and said, without any definite result, that the conclusion is unavoidably arrived at, that while there can be no question of the annoyance and deleterious effects of the emanations from the gullies, and of the great importance of guarding against them, simple as it may appear, it is a subject attended with many difficulties.

Such very opposite views have been put forth by many who stand high in public estimation, and whose opinions are entitled to the utmost confidence, that it is with great deference that I offer the following remarks upon the subject.

Although the generating causes of the evil will doubtless, at a future period, be greatly lessened by an improved system of drainage, or at all events much mitigated, and more easily controlled; and although, by better disposition of the surface currents, great numbers of the gullies themselves might, with advantage, be done away with, and even the dimensions of the fewer number very considerably reduced it must be borne in mind that a long period must necessarily elapse, before these great changes will completely have been realized: that whatever improvements may be effected, the present system of sewers must continue to play an important part in the future arrangements, and that under any circumstances, therefore, the probability is that means which may now be adopted towards the mitigation of the evil in all its strength, may hereafter prove of equal advantage also in counteracting it altogether.

402

The recent attention which has been given to sanitary matters has led to a far greater appreciation of the deleterious effects of these emanations; but the complaints of the bad smells of the gully holes are by no means of recent date.

Twenty years ago, at least, in the Finsbury Division large dip traps were in use, to prevent the effluvia rising.

They consisted of cesspools formed under the grates, four feet in length, two feet six inches in breadth, and six feet in depth, rendered with cement inside, with a dip stone to form a trap. The cost of them was about £6. each.

About 1832, Mr. Roe informs me, great complaints arose of the effluvia from the gullies, and petitions were got up on the subject. Soon after this, iron valves at the bottom of the gully drains appear to have come into use in the Westminster, the City, and in the Holborn and Finsbury Districts.

The experience of their adoption was not long in showing that rendering thus the sewers comparatively air-tight, brought about another evil; the state of the atmosphere within them became unbearable, and dangerous for the men to work in.

Ventilating shafts, rising from the crown of the sewers, and discharging by gratings into the centre of the streets, were then first introduced in the City, and the use of them has continued there and in other districts to the present time.

A considerable amount of benefit is no doubt derived in the wider streets, in thus removing the point of escape to the greatest distance from the houses and the stream of passers-by. In the narrower streets, however, the advantage can be but small. Serious complaint was made on the subject of these shafts, only a few days ago, by the frequenters of Mark-lane; and instances may be found where the ventilating grates to let the foul air out, are within a distance of two or three feet only of the gullies trapped to keep the foul air in.

Mr. Murray has given a calculation, estimating the daily escape of polluted atmosphere from the sewers to cover an area of 4,000 acres one foot deep.

From computations made for other purposes, I am inclined to consider that this area is not far from what would be comprised by the whole surface of the public ways of the dense portion of the Metropolis; and all would join, therefore, in condemnation of any system which discharged this amount of hurtful matter at the level of the streets, into the lower stratum of atmosphere, which all must breathe.

From this experience and past history, one fact is clearly deducible for our guidance in the future; namely, that having in existence several hundred miles of

capacious sewer, for the most part so formed as to favour accumulation of deposit, and the generation of noxious gases, in which it will be long before general improvement can be carried out, and moreover that a great portion of these works will, in any future system, be necessary as a provision in case of storms, and that, however much improved to avoid deposits, they will, if closed against adequate supplies of fresh air, accumulate a fœtid atmosphere of their own, and form at least reservoirs of coal gas, from which the greatest danger is to be apprehended, and the intrusion of which it appears impossible to guard against; and as, under all circumstances, from the very nature of the office and construction of these works, the necessity of men's working in them cannot possibly be obviated, it follows *that no general system of trapping of street gullies can be adopted with advantage without corresponding means of ventilation of the sewers.*

Were there no other objections to the numerous schemes which have, from time to time, been offered against admitting fresh air to the sewers, and for cutting off all circulation within them, this alone would be a fatal objection. Could such a system perfectly be carried out, we should have, I apprehend, precisely those conditions which now obtain in the dead ends of sewers, and which are always in the worst condition, and are the most dangerous to approach.

Captain Vetch has very clearly pointed out, in his communication on this subject, that the foul emanations from the sewers are borne up the gullies by currents of air, and reasoning by analogy with the practice in mines, that these currents may be obviated by flaps across the sewers.

There can, I apprehend, be no question that any strong draught in sewers may by such means be obviated; but I would beg, with deference, to submit that we have here two elements to deal with, instead of one; and under such different circumstances, as to interfere materially with the chances of success from the same treatment as that adopted in mines.

During every tide the majority of the outlets are closed for a considerable period, during which the waters accumulate and expel, in equal proportion, the foul atmosphere at the readiest openings; and currents of fresh air are again admitted as the waters find egress.

Every flap, moreover, when water is discharging from a drain or from a gully into a sewer, becomes an easy opening for air currents; and the very differences of temperature, the atmosphere being for the most part in the sewers warmer than externally, and the gases of less specific gravity than common air, would cause a pressure for discharge at all such openings, or create a current from the lower openings to the higher, even between the points of interception.

406

All experience shows that beyond the currents of air which are carried down with the streams, and with them discharged at the outlets, the general tendency of the atmosphere of the sewers is *upwards;* and thus the gullies being locally the highest points of the system, they for the most part form the upcast shafts, up which the foul vapours, as Captain Vetch has described, are borne in the currents of air.

Foul as the sewers are, an extensive system of ventilation is by these means already in action. It is this system which, while relieving the sewers, causes the evils so loudly complained of; but in attempting to remove it, it has already been seen that another system of ventilation must be substituted. Without it, a partial trapping of the gullies would be a mere shifting of the evil to other neighbouring points, where the inconvenience would be increased by intensity, and the danger certainly heightened; and any general trapping, in the absence of arrangements for ventilation, independently of the fatal objections already pointed out, would be inevitably to create a pressure of poisoned atmosphere at the inlets of the house drains, where being less dilated, and the air more constantly breathed and less readily changed, its evil effects would be infinitely increased.

It remains to be considered, what are the best means of accomplishing this ventilation.

The plan which has been most extensively proposed for a systematic ventilation, and that which has received the countenance of several men of eminence, is by the draught of furnaces and chimney shafts.

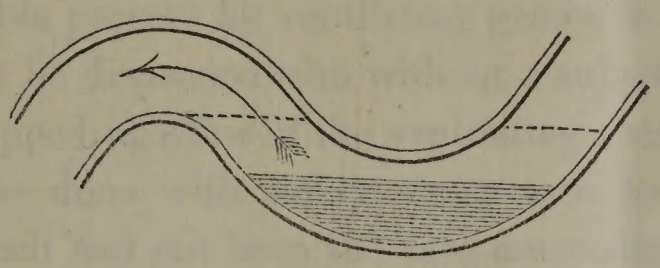
In September, 1848, the sewer in Friar-street, since rendered notorious, being then as now charged with dangerous gases, Mr. Roe and myself joined in a recommendation of Mr. Phillips to try the experiment of drawing off the foul atmosphere from that spot by means of fires. Leaving the question of any chemical objections which may exist to such a process, to those more adequate to pronounce an opinion upon it, further experience and consideration has led me to the conviction, that whatever local benefit, as in the case of Friar-street, might be derived by such a method, even if it could practically be adopted as a system, the results would be far from satisfactory.

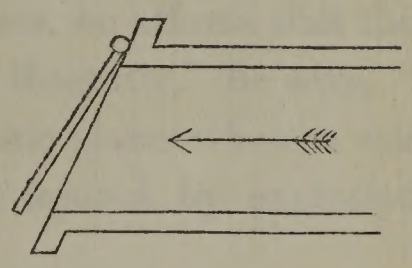
Whatever power of draught may be applied, I am induced to believe that the air would, for the most part, follow only with the greater rapidity from the nearest openings and readiest channels of supply, without producing any sensible effect on the atmosphere at any distance from the spot, or out of the direct course.

Unless, therefore, every opening, both of houses and streets, were effectually trapped, the influence would be felt only in the immediate neighbourhood.

If, with this preliminary ensured, the sewers presented an even and uniform channel for the course of the atmosphere, they might probably feel the beneficial influence of an excessive draught for some considerable distance; but with all the ups and downs of the sewers as they are, the diversities of dimensions, the innumerable connections entering them at every height, and in every possible variety, it appears evident to me, that to produce anything like a good general effect, would require an amount of manual labour to direct the currents from the different channels, little short of the flushing operations themselves.

I am inclined to doubt the result even then; for I apprehend that the resistance to be overcome in drawing the distant atmosphere to the spot, would be far more than that which would be offered to the passage of the air by the traps in close contiguity, presenting only as they do, the opposition of an inch or so in depth of water in the syphon, and still less power in a well hung flap :—





and that the supply would still be kept up, therefore, through the sources, rather than from the desired points at a distance.

In the House Drainage Report occurs this passage :— a

"If every opening into the drains were trapped, however, the pent up atmosphere would soon become most offensive; and as the greater warmth in the house creates the tendency to a draught from the drains, the foul air would be drawn in, unless some free communication were made for its discharge. We would recommend, therefore, that the rain water pipes, which would form a series of ventilating shafts to the sewers and drains without expense, should in all cases, where no inconvenience would arise from it, be left with a free discharge into the drains."

This recommendation, when presented, was received with some degree of doubt, it being feared that inconvenience would for the most part arise from it; subsequent information, however, and practice, has greatly confirmed my impression that herein may consist the means of a complete and inexpensive system of ventilation, whereby, under judicious arrangement, the pressing evils now so loudly calling for amendment, may be mostly, if not altogether obviated.

I have been pleased to find, since the issue of that recommendation, that the practice has long been in operation in Edinburgh, without the slightest annoyance

410

from it. Dr. Stark, writing upon the subject, says, "This pipe (for rain water), being free at both extremities, allows all noxious vapours from the drains to escape directly into the air at the roof of the house."

Mr. Kirkwood, an intelligent plumber, much engaged there in laying tubular drainage, says, "No objections have arisen from this arrangement, while it affords ventilation to the sewers."

The trapping of gullies having only been carried out as a complete arrangement in the City, I applied to Mr. Haywood, the City Surveyor of Sewers, on the subject, and he has kindly furnished me with the result of their experience.

He fully coincides in opinion, that trapping cannot with safety be undertaken without proportionate means of ventilation; but while condemning the present objectionable process by ventilating grates in the streets, he affirms that they cannot with safety be dispensed with without a substitute. "Recently," he says, "through having stopped up a few of the ventilating shafts, in some places where it was deemed it might be done with safety, three men have been injured by explosion of gas, whereas such had not been the case antecedently."

The same effect would doubtless be produced by any extensive trapping, without this or other provision for ventilation.

Mr. Haywood, some months ago, tried also some iron pipes, carried to the tops of the chimney shafts of the houses, and he believes it to be successful. He has found, at all events, that the smoke from exploded gunpowder freely passes off through the pipes.

In the trials which Mr. Murray has recently made, also, an upward current is fully established.

The very facts in connection with the present gullies and ventilating shafts, lead to a conviction of the success of such a system, as well as all other experience of ventilation. They, being the highest points of outlet, now form, in fact,—except when disturbed by counteracting influences, such as the strong currents of water during flushing operations,—the upcast shafts of ventilation.

There can be little doubt that if *higher* points be established, that *they* will in preference become so. Indeed, my own impression is, that if this system of ventilation could be fully carried out, the trapping of gullies might altogether be dispensed with, for that they would then form the *down* instead of the upcast shafts of the system.

412

This, however, would occupy a considerable period of time, and involve a large expense. I would recommend, therefore, that the trapping of all gullies complained of, should be proceeded with, but that the nearest opening for ventilation, by rain-water or other pipe, to the tops of the houses, should at the same time be established.

There may be difficulties in many instances, in inducing the landlords or tenants to permit this connection; but those who seek to be relieved from the nuisance of the gullies, will scarcely deny the means of remedy; and as the trapping, without such relief, is merely a shifting of the evil, and an injustice to others, it should be declined where the ventilation cannot be afforded.

A greater amount of relief would be obtained, and fewer points required, were the connections made with chimney flues, rather than with the small rain-water pipes; but in heavy states of atmosphere, in fog and boisterous winds, when a tendency to down draughts might be created, this would be probably attended with inconvenience. Larger pipes, however, might in many instances be expressly provided, and with Day's "wind-guards" on the top, the upward current would be materially increased with every wind that blew.

Another important question for consideration is, whether the party complaining of the nuisance should be called upon to pay the cost of trapping, or whether it should be charged upon the district rates.

I cannot help thinking it an injustice to individuals to call upon them to defray this expense. The gullies were not placed as they are for private use, but for the purposes of the neighbourhood, and it does seem hard that because the complaining parties have suffered the chief inconvenience, they should be called upon to pay for the remedy.

They are not, however, exclusively the sufferers. In addition to the annoyance which all experience in daily passing these polluted places, numerous authenticated instances are recorded of illness and death, not only among those living in their neighbourhood, but among others also who have casually breathed the poisoned atmosphere while passing by, or standing for a moment near these offensive gullies. Mr. White Cooper, surgeon, who was attending on the Dean of Westminster, and other of the Westminster fever cases, instanced in evidence, before the Metropolitan Sanitary Commission, three cases of fever which had only then recently occurred in his own practice, and which were traced to foul emanations from gullies in Tottenham Court-road and Gray's Inn-lane. Would not the thousands who daily pass these very places gladly be charged with the inappreciable share of the cost of their removal?

It appears probable that some of the very worst of the places are not those of which complaint is made; that the parties residing near to them have not that appreciation either of the nuisance or its evil effects as to trouble themselves concerning its removal, and yet the public daily suffers from them.

It would appear to be a thankful duty, therefore, on the part of the Commission, and one which would be gratefully acknowledged by the public, to seek out these prevalent causes of disease, to order a return at once of the state of the gullies in every district, with the view to the consideration of which of them may be altogether dispensed with, and which may be trapped and ventilated.

Some remarks are made in the House Drainage Report, on the various traps in use in house drains, which would mostly apply also to the trapping of gullies.

Further conditions, however, have here to be regarded; and I will beg to take an early opportunity, therefore, of presenting for consideration a collection of the various forms which may with advantage be applied under the differing circumstances.

The foregoing considerations lead me to conclude, with reference to the present sewers,—

1st. That a system of ventilation of the present sewers cannot be dispensed with.

2nd. That experience has shown that unless simultaneous provision to effect this object be made, the increased trapping of gullies will render the sewers unbearable and dangerous, and will tend seriously to increase the evils intended to be remedied.

3rd. That the trapping should be proceeded with, therefore, only in connection with means of ventilation.

4th. That the present system of ventilation, by shafts and grates discharging in the centre of the streets, is objectionable, and in many instances the smallest mitigation of the evil, and should, therefore, on the adoption of better means, be discontinued.

5th. That any general system of ventilation by connection with furnaces and chimney shafts at considerable distances, would be attended with great difficulties, and much manual labour and current outlay, without promise of very satisfactory results.

6th. That the experience already obtained, as to the draught of air through tubes carried to the tops of houses, gives indication that, under proper management, a good system of self-acting ventilation may by these means be established, and warrants the recommendation that a more extensive and efficient trial should be made of it.

7th. That in proceeding with the trapping of gullies, in order to secure that the worst cases are removed or remedied, under systematic arrangement, rather than leaving it to the chance of complaints and piecemeal performance, a return be ordered of the state of the gullies in each district, with the view of considering the whole question.

8th. That as the gullies were established in their present positions for general and not individual purposes, and that the remedy of the evils arising from them would be beneficial, not alone to the individual complainants, that the cost of trapping and ventilation should not be charged upon them, but be defrayed out of the rates.

HENRY AUSTIN.

8*th October*, 1849.

Metropolitan Sewers.

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